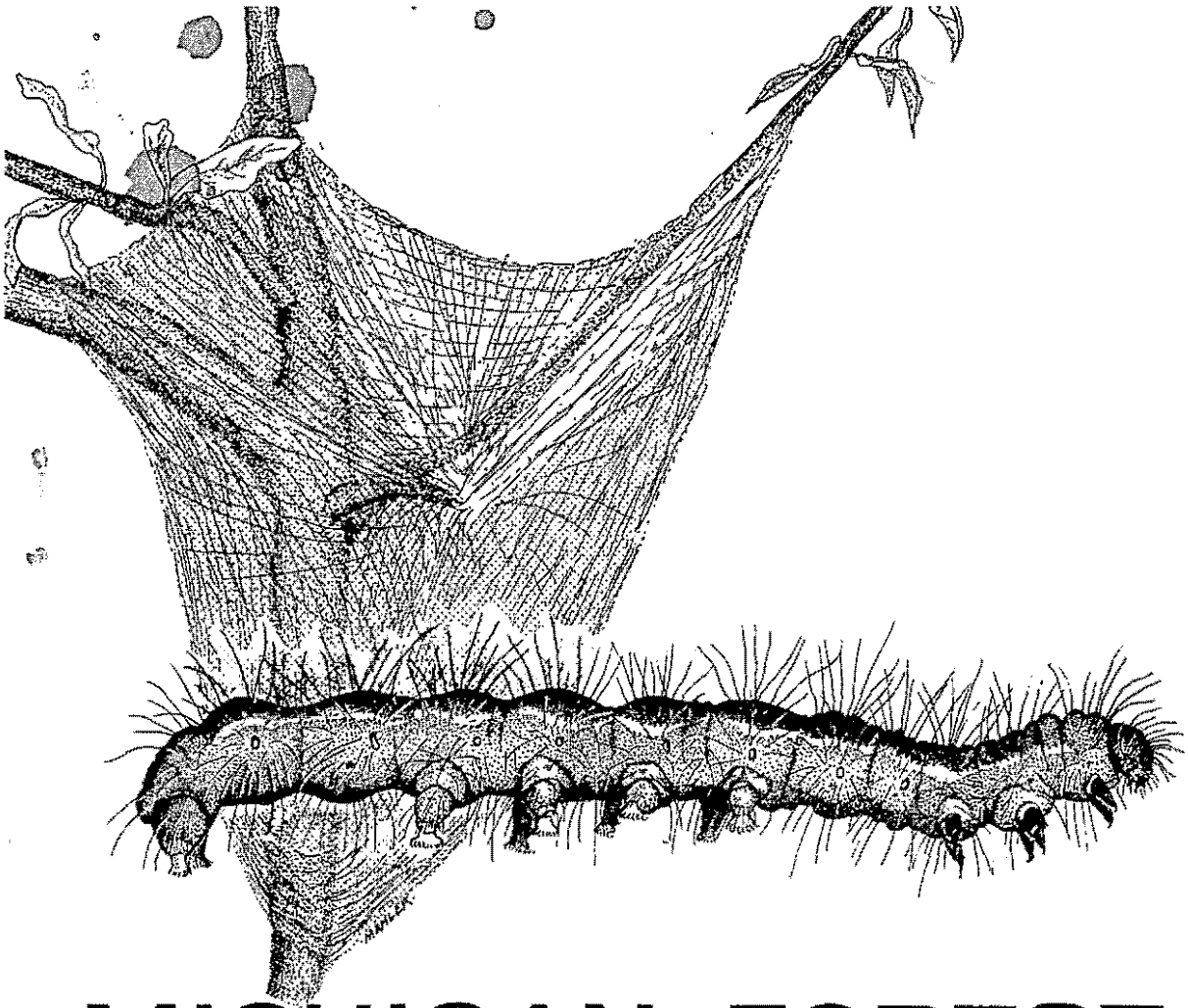
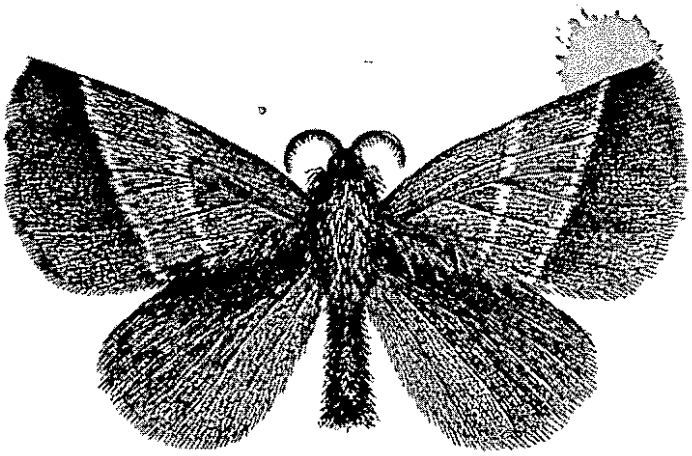


MICHIGAN FOREST PEST CONDITIONS 1977

DANIEL G. MOSHER
Insect and Disease Specialist
Forest Management Division
Michigan Department of Natural Resources

GARY A. SIMMONS
Extension Specialist
Forest Entomology
Michigan State University



"PEST OF THE YEAR"

EASTERN TENT CATERPILLAR
(Malacasoma americanum)

The eastern tent caterpillar, our "Pest of the Year," is pictured on the cover of Forest Pest Conditions. The tent caterpillar was responsible for the most telephone calls, letters, and inquiries handled by both the Department of Natural Resources and the Cooperative Extension Service during 1977. The "population explosion" observed this year is rare, occurring about every 10 to 16 years depending upon climatic conditions.

The tent caterpillar winters in the egg stage and hatches about the time buds unfold from late April through mid-May. Upon hatching, the gregarious caterpillars construct a tent in a nearby crotch and enlarge it as they grow. The larvae venture from the web where they find leaves to feed on, returning to the tent to rest. In June full-grown caterpillars, about 1 1/2 inches long, wander away from the tent in search of places to pupate. Silken cocoons are spun on tree bark, brush, weeds, among dead leaves and debris, and on the sides of buildings. Adult moths appear in midsummer when they deposit eggs in globular masses on twigs and small branches. There is only one generation per year in Michigan.

Although the tent caterpillar "prefers" cherry, it will also develop on other related tree species such as apple. Large caterpillars will feed on almost any deciduous species if food is scarce. Feeding by the larvae, even at high populations, will seldom kill the host tree, although individual branches may succomb.

The eastern tent caterpillar is primarily a nuisance pest. Homeowners are particularly concerned when the characteristic tents materialize on landscape trees. Generally, however, use of pesticides at this time would not prevent further damage but would likely kill natural enemies vitally important in bringing populations down.

Control is best accomplished by pruning off egg masses from the twigs anytime from September through April. Twigs removed in this way should be destroyed by burning. If tents are small when first noticed in the spring, they can also be destroyed by removing and burning.

There will be 2 or 3 more years of high populations of the tent-makers, but larval competition and natural enemies will bring populations to hardly noticeable levels for many years. Our advice--do nothing--watch and enjoy Mother Nature in action!

Cover design: *Our special thanks to Marion Mahler, graphics artist, Graphics Laboratory, Department of Entomology, Michigan State University.*

INTRODUCTION

The Michigan Forest Pest Conditions Report has a new look this year. The Michigan Department of Natural Resources (DNR) has combined forces with Michigan State University (MSU) to come up with a joint report. This joint effort is an indication of the greater degree of cooperation that is evolving in Michigan's Cooperative Forest Pest Management Program. Not only are the DNR and MSU working closer together, but the Michigan Department of Agriculture and the U. S. Forest Service have increased their efforts toward cooperation also. Our aim is to continue along and improve upon these established lines of cooperation.

The report also has a new format. It is divided into five segments that correspond to the five components of the Cooperative Forest Pest Management Program. In addition, a "Pest of the Year" section has been added. A brief description of each segment is given below:

"Pest of the Year" -- This award is given to the forest insect or disease that has made the biggest "pest" of itself during the year. The write-up contains a discussion of the ecological and economic impact of the "Pest of the Year."

Pest Conditions -- This section forms the heart of the report. Information gathered from observations, detection, and evaluation surveys conducted by pest specialists and field personnel of several agencies are reported here. Special recognition should be given to DNR field foresters for their contribution.

Research Progress -- Some of the key forest pest research projects are reported in this section.

Pilot Tests -- New methods developed by research must be pilot tested before they can be implemented on a wide scale. This segment of the report discusses current pilot tests and the results obtained.

Prevention and Control -- This segment will summarize the prevention and control measures implemented during the year. In addition, the management strategy for a major pest will be included.

Information and Education -- A summary of training activities and related functions will be reported in this segment.

We hope the reader will enjoy the new format and expanded information found in this year's report. As the Cooperative Forest Pest Management Program is improved--this report will continue to grow in scope and usefulness.

PEST CONDITIONS

LOWER PENINSULA

INSECTS

PALES WEEVIL (Hylobius pales)

Heavy damage occurred in Christmas tree plantations in the eastern part of the Lower Peninsula. Adult feeding caused some seedling mortality, but the greatest impact resulted from severe branch "flagging." Scotch pine, white pine, and Douglas fir received the heaviest damage. Many trees were rendered unmerchantable.

This problem is caused largely by the "choose and cut" method of harvest used in this area. Fresh-cut stumps are left scattered throughout the plantations each year, favoring a build-up of the weevil population. Attempts at chemical control have met with varied success. The U.S. Forest Service, North Central Forest Experiment Station has begun a research program to study the biology and behavior of the insect. The ultimate goal is to develop a more effective control strategy.

FOREST TENT CATERPILLAR (Malacosoma disstria)

The forest tent caterpillar is on the rise in the Lower Peninsula. Severe defoliation occurred in scattered blocks in Charlevoix and Antrim counties. Scattered heavy defoliation of northern hardwoods and aspen also occurred in Emmet and Cheboygan counties, while populations in Otsego and Montmorency counties were down from previous years. Increasing numbers of caterpillars were reported in many other areas of the Lower Peninsula. Many observers reported increasing numbers of the large sarcophagid fly (Sarcophaga aldrichi) a parasite of the forest tent caterpillar.

EASTERN TENT CATERPILLAR (Malacosoma americanum)

Populations of this insect increased to tremendously high levels this year. The population was extremely high throughout the Lower Peninsula, especially in Newaygo County. Large numbers of larvae starved to death after completely defoliating the cherry in the vicinity. Larvae were observed feeding on sweet fern, blueberry and even grass.

This insect was responsible for causing the greatest public outcry over a forest insect in recent years. Numerous calls and letters were received, expressing concern over the severe defoliation of black cherry and other host trees. But most people were satisfied after they were informed that the tent caterpillar has little impact on the forest.

SADDLED PROMINENT (Heterocampa guttivitta)

Numbers of this pest continued at about the same levels as last year. Light to moderate defoliation of northern hardwoods was reported over widely scattered areas in Emmet, Cheboygan, and Otsego counties. The high population on South Manitou Island collapsed this year.

ARBORVITAE LEAF MINERS (Argyresthia sp.)

In general, leaf miner populations subsided this year as expected. Only one report of noticeable defoliation was received and that was from Oscoda County. Northern white cedar stands have already begun to recover.

LECANIUM SCALES (Lecanium sp.)

Outbreaks of lecanium scales on sugar maple occurred in the town of Plainwell and also on Mackinac Island. In both communities, a broadcast spraying of insecticide was being used to control mosquitoes and flies. It appears that this indiscriminate use of insecticide may have reduced the populations of predators and parasites and thus contributed to the scale outbreaks.

OAK LEAFROLLER (Archips semiferanus)

Heavy defoliation of oak was reported in Montmorency County, with light to moderate defoliation observed in scattered areas throughout the northeastern Lower Peninsula.

SPRUCE BUDWORM (Choristoneura fumiferana)

The scattered outbreaks in Alpena, Presque Isle, and Cheboygan counties continue to decline. This results from much of the overmature balsam fir having been harvested or killed by the budworm in previous years.

GYPSY MOTH (Lymantria dispar)

The Michigan Department of Agriculture, Plant Industry Division and the U.S.Department of Agriculture, Animal and Plant Health Inspection Service continued their cooperative gypsy moth program during 1977.

A total of 12,030 acres were treated with Dimilin in Berrien, Isabella, Mecosta, Saginaw and Washtenaw counties. In addition, the usual trapping program was conducted.

OTHER INSECTS

An outbreak of SPRING and FALL CANKERWORMS (Paleacrita vernata and Alsophila pometaria) continued this year in Cass County. Severe defoliation of mixed hardwood species was reported.

The PINE ROOT COLLAR WEEVIL (Hylobius radicis) continued to be the most significant problem on Scotch pine in the northwest part of the Lower Peninsula. Red pine plantations growing adjacent to Scotch or jack pine are often seriously damaged also.

Populations of the PITCH MIDGE (Cecidomyia sp.) were much lower this year in the northcentral Lower Peninsula. But damage on jack pine was still noticeable in some areas.

In Cass County it was reported that black cherry, growing adjacent to some trees that had been harvested, were being heavily attacked by the PEACH BARK BEETLE (Phloeotribus liminaris). Apparently the bark beetles were building up on the slash and attacking trees that were probably stressed from earlier defoliation by eastern tent caterpillar and drought. No mortality was observed, but heavily attacked trees were covered with oozing sap.

Black cherry in Osceola County showed heavy stippling caused from feeding by a CHERRY LACE BUG (Corythucha sp.)

DISEASES

WESTERN GALL RUST (Endocronartium harknesii)

A survey was conducted in cooperation with Michigan State University to determine the distribution of western gall rust in the Lower Peninsula. Both Scotch pine and jack pine were surveyed. Some of the counties where scattered pockets of the disease were found are: Otsego, Emmet, Kalkaska, and Missaukee. Nearly all of the western gall rust was found on Scotch pine Christmas trees, while nearly all of the galls found on jack pine were eastern gall rust.

Western gall rust can spread from pine to pine and cause serious tree mortality. In fact, some of the Scotch pine plantations we surveyed had already sustained significant mortality and branch "flagging." This disease has the potential of becoming an important problem in Christmas tree plantations.

A chemical control, using maneb, has been developed but is not registered yet.

ARTIST'S CONK (Fomes applanatas)

This fungus, which causes a root and butt rot in many hardwood species, was found to be responsible for causing extensive mortality of sugar maple in two Clinton County woodlots. Normally this decay fungus only attacks heartwood and other tissue in living trees. But in these two instances, the fungus was found killing living sapwood. The reason for this may be found in the history of the two stands.

Both stands had a history of tapping for syrup production, grazing by cattle, and past logging. These factors resulted in a tremendous amount of trunk and root wounds. In addition, the trees were very low in vigor due to over-maturity and crowding.

This situation points out the importance of good management in avoiding such pest problems.

OAK WILT (Ceratocystis fagacearum)

The incidence of this disease remained at about the same level as last year. While the disease was not found in any new counties, the infection that was discovered in Roscommon County last year continued to spread. This infection center is in a residential area which makes treatment more difficult.

OAK ANTHRACNOSE (Gnomonia quercina)

Browning of white and red oaks of all sizes was widely reported in Clare, Crawford, and Grand Traverse counties. Even though this was a dry year, apparently there was sufficient moisture at the right time for good infection.

MISCELLANEOUS

WINTER BROWNING

The severity of last winter caused extensive browning on many conifer species. Exposed trees seemed to be especially hard hit with some susceptible varieties of Scotch pine Christmas trees being severely damaged. This problem was responsible for many inquiries from the public.

DROUGHT

The drought experienced in most areas during 1976 continued and intensified this year. Relief finally arrived when rains started in late July.

With the drought, came the usual problems including: mortality in new pine plantations, leaf scorch and general decline of urban trees and scattered bark beetle flare-ups. Hopefully, the major impact is over, but some effects of a drought often do not become evident until years later.

UPPER PENINSULA

INSECTS

FOREST TENT CATERPILLAR (Malacosoma disstria)

The current outbreak in the Upper Peninsula moved into its third year and expanded considerably in size. The outbreak now covers approximately 741,000 acres. On the west side of the Upper Peninsula, aspen is the primary host, while on the east side both northern hardwoods and aspen were defoliated.

The outbreak is generally divided into three areas; western, central, and eastern. An aerial survey conducted by the U.S. Forest Service, combined with reports from Department of Natural Resources field foresters, gives a breakdown of defoliation as follows:

Western area--(Ontonagon, Houghton, Gogebic, Baraga, and Iron counties):

Heavy defoliation ----------	58,000 acres
Light to moderate defoliation-	431,000 acres

Central Area--(Alger, Schoolcraft, and Delta counties):

Moderate to heavy defoliation--	5,000 acres
Light to moderate defoliation--	92,000 acres

Eastern area--(Mackinac, Chippewa, and Luce counties):

Moderate to heavy defoliation--	56,000 acres
Light to moderate defoliation--	99,000 acres

So far, there has been no significant tree mortality attributed to defoliation by the forest tent caterpillar alone. The major impact has been in terms of growth loss, aesthetic loss, and nuisance. Past outbreaks of this insect in Michigan have lasted from 2 to 4 years, so this population should begin to decline within the next couple of years. Numerous reports of large numbers of the parasite (Sarcophaga aldrichi) support this contention.

SPRUCE BUDWORM (Choristoneura fumiferana)

Overall, the budworm situation appeared to be about the same as last year. An aerial survey conducted by the U.S. Forest Service on the Ottawa National Forest showed a drop in the amount of defoliation. On the other hand, D.N.R. field foresters

reported increasing damage in Iron, Mackinac, Marquette, and Luce counties. An aerial survey of the Hiawatha National Forest showed that defoliation was about the same as last year or slightly higher.

Our recommendation remains the same: if you have markets in your area, take advantage of them. Sell as much of your mature and over mature balsam fir and white spruce as you can. Even if budworm populations drop periodically, these stands are still susceptible.

SADDLED PROMINENT (Heterocampa guttivitta)

Populations of this insect increased over last year's levels. A listing of reported defoliation of northern hardwoods is given below:

County	Acreage	Degree of Defoliation
Alger, Schoolcraft	50,000	Light
Luce	5,000	Moderate
Mackinac, Chippewa	30,000	Moderate to Heavy
Total	85,000	

Defoliation was also reported on the Garden Peninsula in Delta County.

The hardest hit area is on Drummond Island, where about 1,800 acres were defoliated twice last year (once by forest tent caterpillar) and again this year. Mortality of maple and beech is near 10 percent with many of the remaining trees showing top dieback. The beech seems to have suffered the most from the defoliations. The defoliation has resulted in some beneficial thinning by removing some of the ironwood.

MAPLE DEFOLIATORS

Defoliation by a group of insects including the linden looper (Erannis tiliara) and another looper (Physiostegania pustularia) was down from last year. About 5,000 acres were lightly defoliated in Alger County.

BIRCH LEAF MINER (Fenusa pusilla)

This insect continued to be a perennial problem. Moderate heavy defoliation was reported in Alger, Schoolcraft, Dickinson, and Marquette counties.

OTHER INSECTS

The LARCH SAWFLY (Pristiphora erichsonii) was reported causing moderate to heavy defoliation of tamarack over much of Iron, Dickinson, Luce, and Chippewa counties.

Light defoliation of red maple was caused by the GREEN-STRIPED MAPLEWORM (Anisota rubicanda) Mackinac County.

THE HEMLOCK LOOPER (Lambdina fiscellaria) was responsible for light to moderate defolition of hemlock in scattered areas throughout Alger and Schoolcraft counties.

DISEASES

EUTYPELLA CANKER (Eutypella parasitica)

A cooperative survey was conducted with the U.S. Forest Service, State and Private Forestry to determine the distribution and severity of Eutypella canker on hard maple in the Upper Peninsula. In general, the incidence of the disease was low in most stands with the exception of an area in the western Upper Peninsula where significant amounts of the disease were found. A survey report with management recommendations will be distributed to land managers.

SCLERODERRIS CANKER (Gremmeniella abietina)

The only new development regarding scleroderris in Michigan is that the name has been changed. Other than that, the situation remains about the same with the major area of infection occurring in the Danaher Plains.

Research continues in New York State on the European strain of the fungus that is causing serious mortality of red and Scotch pine. The U.S. Department of Agriculture Animal and Plant Health Inspection Service has placed a quaranteen on the area in New York where the disease occurs in an effort to prevent its spread on nursery stock and Christmas trees.

DUTCH ELM DISEASE (Ceratocystis ulmi)

The situation is basically unchanged from last year, with losses continuing in the western Upper Peninsula.

RESEARCH PROGRESS

SPRUCE BUDWORM (Choristoneura fumiferana)

Our recent studies of spruce budworm population have disclosed that natural enemies, particularly parasitic insects, respond to forest stand composition and density. Dense stands of pure balsam fir and spruce are not good for egg, larval, and pupal parasites.

Moderately dense stands of spruce and fir mixed with hardwood species have especially high rates of parasitism. Also, mixed stands impart higher mortality when tiny larvae disperse in the spring and fall. We hope to establish silvicultural guidelines which assume maximum budworm mortality through stand management.

GYPSY MOTH (Lymantria dispar)

Although the gypsy moth has been in Michigan since 1970, research on the threatening bug did not begin here until late 1976. Dr. Ring Carde and colleagues in the Chemistry Department at Michigan State University synthesized the true sex pheromone of the moth. Such an important scientific breakthrough will have a profound effect on our ability to detect populations in new areas and old. In addition, Dr. Carde and colleagues began field research with the new compound to develop quantitative scientific survey techniques that can be used in the future to predict population densities of the caterpillars and expected damage they will cause.

A computer simulation model of gypsy moth in Michigan has also been constructed. The simulation model is used to "experiment" with different strategies of control and evaluate the outcome without the risk of losing real trees and forests.

INSECTS ON WALNUT

Our studies of insect problems on black walnut address primarily troubles created by Acrobasis sp. We find a wide range of population densities dependent upon plantation age and size. The insects feed on both terminal buds and developing shoots. Larvae established in terminal buds result in bud abortion leading to forking and branchiness. This compliments a similar circumstance resulting from frost damage. About 50 percent of forking and branchiness is caused by Acrobasis sp. and about 50 percent is caused by frost. Corrective pruning of growing shoots shows promise as a management technique.

Both Acrobasis juglandis and A. demotella appear to experience one generation per year in Michigan. Winter is passed as 2nd or 3rd instars within hibernaculae spun on or near terminal or lateral buds. Feeding is initiated when buds begin to swell in the spring. Larvae mine terminal buds and shoots then spin tubes which are attached to leaf blades where they pupate. Adult moths emergy in late June to mid-July and lay single eggs on the underside of leaflets. Larvae hatch within a few days and feed by skeletonizing the foliage. There are about 25 species of parasitoids which attack larvae and pupae.

Both Methoxychlor and Orthene were efficacious against larvae in the spring. Barrier bands of Tangle Foot were also effective when applied before spring emergence of larvae. Tests of early fall applications of insecticides are not yet completed.

CHRISTMAS TREE INSECTS

Studies of the eastern pineshoot borer (Eucosma gloriola) have shown some interesting patterns. Most attacks by the moth occur on lateral shoots of the uppermost whorl. Scotch pine trees from 3 to 4 feet in height are the most commonly attacked. Apparently regular shearing of trees corrects any problems caused by the boring larvae and no chemical control is required except under very intense outbreaks.

JACK PINE INSECTS

Jack pine trees in the northern part of the Lower Peninsula showed brown tips in some locations. Close examinations disclosed intense attacks by the pine pitch midge (Cedidomyia sp.). Peculiar, however, was the fact that pairs of adjacent trees often showed marked differences in attack intensity. Usually one tree showed anywhere from 10 to 80 brown tips per 100 shoots while the adjacent tree showed less than 5 brown tips per 100 shoots. Attacked trees were generally less vigorous and showed evidence of previous damage caused by the pitch midge and other insects. Apparently some genetic resistance (or tolerance) for pitch midge does exist in jack pine populations. This study will hopefully lead to a better understanding of endemic insect populations in jack pine forests.

BRONZE BIRCH BORER (*Agrilus anxius*)

An initial survey of white barked birches growing at private homes in Okemos, Michigan, showed that European birch was most heavily attacked by bronze birch borer. Canoe birch was much less infested, and gray birch was free of bronze birch borer. All species under a spray protection program were in excellent condition and were free or nearly free of bronze birch borer attack. Further investigations will be conducted to substantiate the initial findings. It is thought that European birch is the most widely grown and marketed because its bark turns white at the earliest age, a desirable trait in the selection by homeowners. Future studies will develop a vigor risk rating system and other species of birches will be tested for borer resistance.

INSECT PREDATORS

In the past three years, there have been two studies made on ground-beetles, family Carabidae. The first and longest study has been concerned with the life history and biology of two forest species, *Pinacodera limbata* and *P. platicollis*. Both of these species are active in the canopy of the forest but little is known of their habits and the role they play in the forest ecosystem. It is presently felt that they are predators of smaller caterpillars and other soft bodied insects, however, they have been found feeding on oozing sap and fruit, as well.

The second study, conducted this year, compared the carabid fauna between three different forest sites reflecting three different types of stands. The data is being analyzed for diversity of carabid species and the dominance of any particular species. Both of these studies have been conducted in the Manistee National Forest in Lake County, near Baldwin. Both of these studies will lead to a better understanding of natural biological control agents in our oak forests.

PALES WEEVIL (*Hylobius pales*)

The U. S. Forest Service, North Central Forest Experiment Station, began a research project this year to study the biology and behavior of this insect on Christmas trees. Their goal is to develop more effective management practices to reduce the impact of this pest.

ORCHARD/WOODLOT STUDIES

Recent insect surveys in commercial orchards, abandoned orchards, and adjacent natural woodlots showed many insects native to woodlots also present in abandoned orchards. Such data suggests further studies of these insects in natural woodlots would lead to controls which decrease the chemical pesticide usage in commercial orchards.

NEEDLE CASTS OF DOUGLAS-FIR

Studies are continuing at the University of Michigan to develop and refine fungicidal control practices for Swiss needle cast (Phaeocryptopus gaumanni) and Rhabdocline needle cast (Rhabdocline weirii). These studies found that, although it is not yet widely distributed in Michigan, Rhabdocline needle cast rendered 71 percent of the Douglas fir unmerchantable in one Emmet County Christmas tree plantation.

PILOT TESTS

PINE ROOT COLLAR WEEVIL (Hylobius radicis)

A cooperative project involving the Michigan Department of Natural Resources, Michigan State University, and U.S. Forest Service began this year to test early basal pruning and duff removal for control of pine root collar weevil on a wide scale. Six red pine plantations and eight Scotch pine plantations in the northwestern Lower Peninsula were selected as test sites. Most of the plantations received three treatments: all trees treated; 50 percent of the trees treated; and check plots (no treatment). Time checks were also made to develop time-cost information for land managers.

Next year the evaluation part of the test will begin. Trees will be cut and the stumps dug to determine the number of weevils infesting them. Comparisons will be made between treated and untreated trees.

JACK PINE BUDWORM (Choristoneura pinus)

Six jack pine stands were selected as sites on which to test residual overstory removal as a method to reduce jack pine budworm hazard. Four of the stands are located in the Upper Peninsula and two in the Lower Peninsula. All stands are approximately 80 acres and contain varying degrees of overstory left standing at the time of harvest. The stands also have an adequate stocking of regeneration. The overstory will be removed next year from about 60 acres in each stand, with a 20 acre area of overstory left as a control. Budworm populations and damage will be monitored and comparisons made between treated and untreated areas. This pilot test is a cooperative project between the Michigan Department of Natural Resource, Michigan State University and U. S. Forest Service.

MAPLE LEAF CUTTER (Paraclemensia acerifoliella)

Control burning of leaf litter in the springtime shows promise as a control for hardwood insects which spend a portion of their lifespan among the leaves on the forest floor. A pilot test of spring burning showed excellent results with the maple leaf cutter in a woodlot in Benzie County.

The advantage of spring burning is that succulent vegetation prevents the heat of the fire from scorching large trees, but still allows high enough temperatures to kill leaf cutter pupae. Plans are being made to follow up with large scale tests.

PREVENTION AND CONTROL

HOW TO CONTROL THE PINE ROOT COLLAR WEEVIL*

The pine root collar weevil, Hylobius radicis Buchanan (Coleoptera: Curculionidae), injures many species of pines including Scotch, jack, red, Austrian, Corsican, mugo, lodgepole, pitch, ponderosa and eastern white. It is the most destructive insect pest of young Scotch pines, and can be a serious pest of red pine. Standing dead trees are the result of girdling by dense populations of the larvae. Other trees, partially girdled by lighter populations, often blow down in strong winds or lean over under the weight of heavy snows.

Damage -- The first sign of larval feeding is a subtle change in the height of young pines. In an even-aged plantation, a moderate to heavy population of weevils is present when the leader growth of the tallest trees equals leader growth of the shortest trees. A single dead tree indicates a severe infestation.

The larval state injures trees by penetrating the outer bark below the soil surface and feeding on the inner bark. A swollen trunk at the ground line surrounded by darkened pitch infiltrated soil indicates an advanced infestation. The leaf litter and some of the topsoil should be scraped away to confirm an injured root collar.

Description -- The larva is white, curved and legless with a brown head. When fully grown, it measures 3/8 to 1/2 inch long, varies from reddish-brown to black, and has irregular patches of white to yellow scales.

Life History -- Both adults and larvae overwinter in or near the root collar. Eggs are laid from May through September with peak numbers occurring in late June and July. Larvae first appear in June and pupation takes place in the soil from June to September the following year. Adults emerge in late summer and early fall and may live for more than a year.

Why Infestations Develop -- Pine root collar weevil adults perish when soil temperatures exceed 104°F (40°C). Thus, during the day the adult weevils hide under the leaf litter at the root collar where it is cool and dark. There the females lay eggs. Cooler night temperatures favor movement, at which time they meander from tree to tree and up into the crown where they feed

---

**From an article by Gary Simmons and Louis Wilson in: Michigan Christmas Tree Journal, Spring, 1977.*

on small branches. Pine plantations are most susceptible when planted near an already infested stand, because its weevils will move in and attack the young trees.

Hazard Zones -- Scotch and red pine are the two primary pines planted in Michigan. Scotch pine is extremely susceptible to the pine root collar weevil. Scotch pine occurs in a high hazard zone primarily in the northwestern area of the Lower Peninsula--the area where most Christmas trees are grown. The hazard zones for red pine are shown in Figure 1.

Control In Infested Plantations (with 1 dead tree or more)-- Reddish-brown trees have already succumbed and cannot be saved. Trees which are beginning to turn yellow are almost dead and also cannot be saved. The rest of the plantation should be pruned. On red pine, prune the lower 2 to 4 feet of branches and rake away the duff beneath the trees. If Scotch pine are grown for Christmas trees, the lower 1 foot of branches should be removed and the leaf litter raked away. This hinders the normal daytime activities of the adults and provides an environment unsuitable for their survival. Pruning can be done at anytime, but attacks are halted quicker if done in the spring before eggs are laid.

Preventing Damage (in Plantations without Dead Trees) -- Both Scotch and red pine trees are relatively free from attack until they reach about 1 inch in diameter at the base. After that time they should be pruned and the leaf litter removed if they show signs of attack or there is a high probability of infestation.

Establishing Plantations -- If Scotch pine is planted, several varieties from western and southern Eurasia should be selected (Scotland, Spain, southern France, Italy, Yugoslavia, Greece, Turkey, Georgian SSR) as these are least susceptible. If possible, Scotch pine should be planted at least 1 mile or further from infested trees if in the high hazard zone. If infested areas are replanted after harvest, the entire site should be cleanly cultivated of all host trees before planting. Probability of damage to red pine planted at various distances from a weevil infestation is shown in Table 1.

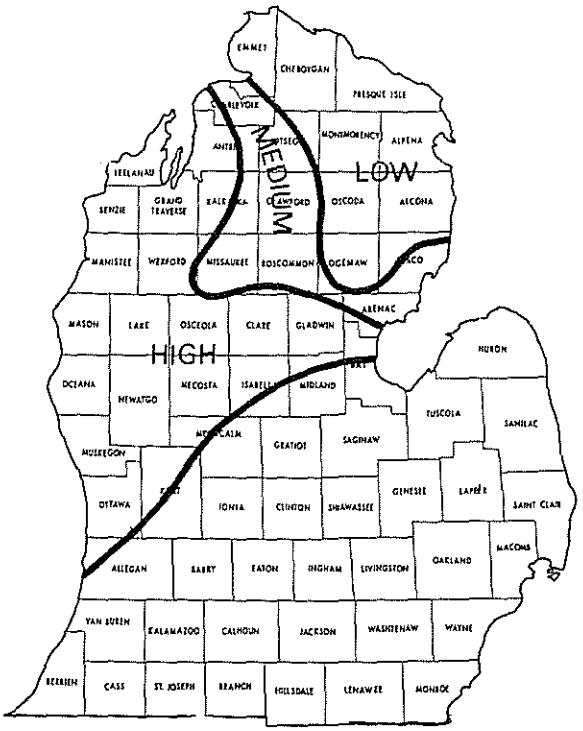


Figure 1 -- *Low, medium, and high weevil hazard zones for red pine in lower Michigan. The weevil hazard in the unmarked zone is unknown.**

Table 1.-- *Probability of heavy damage to red pine from root collar weevil, by hazard zone and distance to a weevil infestation.**

Distance to weevil infestation	Hazard Zones		
	Low	Medium	High
Miles	Percent	Percent	Percent
0 - 1/8	5	15	>50
1/8 - 1/2	5	10	40
1/2 - 1	5	5	25
1+	>5	5	10

**From U.S.F.S. Research Note NC-104*

INFORMATION AND EDUCATION

A major effort will be made during 1978 to expand and develop the information and education component of the Cooperative Forest Pest Management Program. The Michigan DNR and MSU will combine efforts to provide more training programs for forest land managers. In addition, there will be an increased number of handouts and extension bulletins produced to help keep the public informed about forest insect and disease problems. There will also be more press releases on current pest problems.

Our goal will be to keep land managers (government and private), Christmas tree growers, and the general public informed and up-to-date on forest pest problems and the technology available to deal with them. Keeping people informed is one of the first steps in reducing both the economic and social impact of forest pests.